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(54) Title: MONO-DIAMETER WELLBORE CASING

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(57) Abstract: A mono-diameter wellbore casing.

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C. DOCUMENTS CONSIDERED TO BE RELEVANT						
Category #	Citation of document, with indication, where a	opropriate, of the relevant passages	Relevant to claim No.			
A	US 2002/0033261 A1 (METCALFE) 21 March 200	2 (21.03.02), summary.	1-55			
A	US 6,085,838 A (VERCAEMER et al.) 11 July 200	00 (11.07.02), figures 5-7.	1-55			
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Further	r documents are listed in the continuation of Box C.	See patent family annex.				
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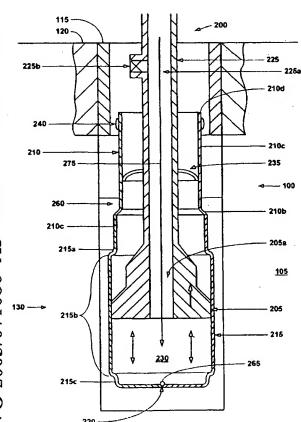
- (71) Applicant (for all designated States except US): ENVENTURE GLOBAL TECHNOLOGY [US/US]; 16200 A Park Row. Houston, TX 77084 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): COOK, Robert,

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(54) Title: MONO-DIAMETER WELLBORE CASING



(57) Abstract: A mono-diameter wellbore casing.

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#### AMENDED CLAIMS

[Received by the International Bureau on 15 July 2004 (15.07.04): original claims 1 - 55 amended; new claims 56 - 78 added (2 pages)]

#### Claims

1. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

an expansion cone coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion cone; and an expandable shoe coupled to the expandable tubular liner; wherein the expansion cone is adjustable to a plurality of stationary positions.

- 2. The apparatus of claim 1, wherein the expandable shoe includes a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe.
- 3. The apparatus of claim 1, wherein the expandable shoe includes: an expandable portion; and a remaining portion coupled to the expandable portion; wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.
- 4. The apparatus of claim 3, wherein the expandable portion includes: one or more inward folds.
- 5. The apparatus of claim 3, wherein the expandable portion includes: one or more corrugations.
- 6. The apparatus of claim 1, wherein the expandable shoe includes: one or more inward folds.
- 7. The apparatus of claim 1, wherein the expandable shoe includes: one or more corrugations.
- 8. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole; radially expanding at least a portion of the shoe by a process comprising: adjusting the adjustable expansion cone to a first outside diameter; and injecting a fluidic material into the shoe; and radially expanding at least a portion of the tubular liner by a process comprising; adjusting the adjustable expansion cone to a second outside diameter; and injecting a fluidic material into the borehole below the expansion cone.

- 9. The method of claim 8, wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.
- 10. The method of claim 8, wherein radially expanding at least a portion of the class further comprises:

lowering the adjustable expansion cone into the shoe; and adjusting the adjustable expansion cone to the first outside diameter.

11. The method of claim 8, wherein radially expanding at least a portion of the shoe further comprises:

pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material, and

pressurizing an annular region above the adjustable expansion cone using the fluidic material.

12. The method of claim 8, wherein radially expanding at least a portion of the tubular liner further comprises:

pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material.

13. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole:

means for radially expanding at least a portion of the shoe comprising:
means for adjusting the adjustable expansion cone to a first outside diameter; and
means for injecting a fluidic material into the shoe; and
means for radially expanding at least a portion of the tubular liner comprising:
means for adjusting the adjustable expansion cone to a second outside diameter;
and

means for injecting a fluidic material into the borehole below the adjustable 'expansion cone.

- 14. The system of claim 13, wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.
- 15. The system of claim 13, wherein the means for radially expanding at least a portion of the shoe further comprises:

means for lowering the adjustable expansion cone into the shoe; and means for adjusting the adjustable expansion cone to the first outside diameter.

- 16. The system of claim 13, wherein the means for radially expanding at least a portion of the shoe further comprises:
  - means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
  - means for pressurizing an annular region above the adjustable expansion cone using the fluidic material.
- 17. The system of claim 13, wherein the means for radially expanding at least a portion of the tubular liner further comprises:

means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion cone using the fluidic material.

18. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

- a first wellbore casing comprising:
- an upper portion of the flist wellbore casing, and
- a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
- wherein the inside diameter of the upper portion of the first wellbore casing to less than the inside diameter of the lower portion of the first wellbore casing and a second wellbore casing comprising:
- an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
- a lower portion of the second wellbore casing coupled to the upper portion വ് പ്ര second wellbore casing;
- wherein the inside diameter of the upper portion of the second wellbore coming than the inside diameter of the lower portion of the second wellbore coming; and
- wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
- installing the second wellbore casing and an adjustable expansion cone within the borehole:
- radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:
- adjusting the adjustable expansion cone to a first outside diameter, and injecting a fluidic material into the second wellbore casing; and radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:
- adjusting the adjustable expansion cone to a second outside diameter; and injecting a fluidic material into the borehole below the adjustable expansion cone.
- 19. The wellbore casing of claim 18, wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

20. The wellbore casing of claim 18, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

lowering the adjustable expansion cone into the lower portion of the second wellbore casing; and

adjusting the adjustable expansion cone to the first outside diameter.

21. The wellbore casing of claim: 18, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion cone using a fluidic material; and pressurizing an annular region above the adjustable expansion cone using the fluidic material.

22. The wellbore casing of claim 18, wherein radially expanding at least a portion of the upper portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion cone using a fluidic material; and pressurizing an annular region above the adjustable expansion cone using the fluidic material.

- 23. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:
  - a support member including a first fluid passage;
  - a first adjustable expansion cone coupled to the support member including a second fluid passage fluidicity coupled to the first fluid passage;
  - a second adjustable expansion cone coupled to the support member including a third fluid passage fluidicity coupled to the first fluid passage;
  - an expandable tubular liner movably coupled to the first and second adjustable expansion cones; and

an expandable shoe coupled to the expandable tubular liner.

24. The apparatus of claim 23, wherein the expandable shoe includes a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe.

- 25. The apparatus of claim 23, wherein the expandable shoe includes:
  an expandable portion; and
  a remaining portion coupled to the expandable portion;
  wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.
- 26. The apparatus of claim 25, wherein the expandable portion includes: one or more inward folds.
- 27: The apparatus of claim 25, wherein the expandable portion includes: one or more corrugations.
- 28. The apparatus of claim 23, wherein the expandable shoe includes: one or more inward folds.
- 29. The apparatus of claim 23, wherein the expandable shoe includes: one or more corrugations.
- 30. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

adjusting the lower adjustable expansion cone to an increased outside diameter; and
injecting a fluidic material into the shoe; and
radially expanding at least a portion of the tubular liner by a process comprising:
adjusting the lower adjustable expansion cone to a reduced outside diameter;
adjusting the upper adjustable expansion cone to an increased outside diameter; and
injecting a fluidic material into the borehole below the lower adjustable expansion
cone.

31. The method of claim 30, wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone.

- 32. The method of claim 30, wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.
- 33. The method of claim 30, wherein radially expanding at least a portion of the shoe further comprises:

lowering the lower adjustable expansion cone into the shoe; and adjusting the lower adjustable expansion cone to the increased outside diameter.

34. The method of claim 30, wherein radially expanding at least a portion of the shoe further comprises:

pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

35. The method of claim 30, wherein radially expanding at least a portion of the tubular liner further comprises:

pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

36. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the lower adjustable expansion cone to an increased outside diameter; and

means for injecting a fluidic material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion cone to a reduced outside diameter;

means for adjusting the upper adjustable expansion cone to an increased outside diameter; and

means for injecting a fluidic material into the borehole below the lower adjustable expansion cone.

- 37. The system of claim 36, wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upcome adjustable expansion cone.
- 38. The system of claim 36, wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.
- 39. The system of claim 36, wherein the means for radially expanding at least a portion of the shoe further comprises:

means for lowering the lower adjustable expansion cone into the shoe; and means for adjusting the lower adjustable expansion cone to the increased outside diameter.

40. The system of claim 36, wherein the means for radially expanding at least a portion of the shoe further comprises:

means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion cone using the fluidib material.

41. The system of claim 36, wherein the means for radially expanding at least a portion of the tubular liner further comprises:

means for pressurizing a redion within the shoe below the lower adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion cone using the fluidid material.

- 42. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
  - a first wellbore casing comprising:
  - an upper portion of the first wellbore casing; and
  - a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
  - wherein the inside diameter of the upper portion of the first wellbore casing to less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:
  - an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
  - a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;
  - wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
  - wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;
  - wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
  - installing the second wellbure casing, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the bojehole;
  - radially expanding at least a portion of the lower portion of the second wellbore casing shoe by a process comprising:
  - adjusting the lower adjustable expansion cone to an increased outside diameter; and injecting a fluidic material into the lower portion of the second wellbore casing; and radially expanding at least a portion of the upper portion of the second wellbore

casing by a process comprising:

adjusting the lower adjustable expansion cone to a reduced outside diameter; adjusting the upper adjustable expansion cone to an increased outside diameter; and injecting a fluidic material into the borehole below the lower adjustable expansion cone.

- 43. The wellbore casing of claim 42, wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone.
- 44. The wellbore casing of claim 42, wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.
- 45. The wellbore casing of claim 42, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

lowering the lower adjustable expansion cone into the lower portion of the second wellbore casing; and adjusting the lower adjustable expansion cone to the increased outside diameter.

The wellbore casing of claim 42, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

47. The wellbore casing of claim 42, wherein radially expanding at least a portion of the upper portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

48. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

an expansion cone coupled to the support member including a second fluid passage fluididy coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion cone; and

an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the
expandable shoe

an expandable portion comprising one or more inward folds; and
a remaining portion coupled to the expandable portion;
wherein the outer circumference of the expandable portion is greater than the outer
circumference of the remaining portion;
wherein the expansion cone is adjustable to a plurality of stationary positions.

49. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole; radially expanding at least a portion of the shoe by a process comprising: lowering the adjustable expansion cone into the shoe; adjusting the adjustable expansion cone to a first outside diameter; pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and pressurizing an annular region above the adjustable expansion cone using the fluidic

material; and radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the adjustable expansion cone to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion cone using a

fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material;

wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

50. A system for forming a well-ore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole:

means for radially expanding at least a portion of the shoe comprising: means for lowering the adjustable expansion cone into the shoe;

means for adjusting the adjustable expansion cone to a first outside diameter, means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion cone using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:
means for adjusting the adjustable expansion cone to a second outside diamater;
means for pressurizing a region within the shoe below the adjustable expansion cone
using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion compusing the fluidic material.

wherein the first outside diameter of the adjustable expansion cone is greater then the second outside diameter of the adjustable expansion cone.

51. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second welloore casing and an adjustable expansion cone in the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:

lowering the adjustable of pansion cone into the lower portion of the second wellbore casing;

adjusting the adjustable expansion cone to a first outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion cone to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material:

wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

- 52. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:
  - a support member including a first fluid passage;
  - a first adjustable expansion cone coupled to the support member including a second fluid passage fluidicty coupled to the first fluid passage;
  - a second adjustable expansion:cone coupled to the support member including a third fluid passage fluidicily coupled to the first fluid passage;
  - an expandable tubular liner movably coupled to the first and second adjustable expansion cones; and

an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe:

an expandable portion comprising one or more inwards folds; and

a remaining portion coupled to the expandable portion;
wherein the outer circumference of the expandable portion is greater than the outer
circumference of the remaining portion.

53. A method of forming a wellbore casing in a subterransan formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the lower adjustable expansion cone into the shoe;

adjusting the lower adjustable expansion cone to an increased outside diamater; pressurizing a region within the shoe below the lower adjustable expansion expansion.

using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cons using the fluidic material; and

radially expanding at least a portion of the tubular liner by a process comprising: adjusting the lower adjustable expansion cone to a reduced outside diameter; adjusting the upper adjustable expansion cone to an increased outside diameter; pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone; and

wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

54. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole; means for radially expanding at least a portion of the shoe comprising:

means for lowering the lower adjustable expansion cone into the shoe;

means for adjusting the lower adjustable expansion cone to an increased outside diameter.

means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion cone using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion cone to a reduced outside diameter;

means for adjusting the upper adjustable expansion cone to an increased outside diameter;

means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion cone using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone; and

wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

- 55. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
  - a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

- a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;
- wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
- wherein the inside diameter of the upper portion of the first wellbore casing to equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
- installing the second wellbore casing, an upper adjustable expansion cone. and a lower adjustable expansion cone in the borehole;
- radially expanding at least a portion of the shoe by a process comprising:
  lowering the lower adjustable expansion cone into the lower portion of the expanding wellbore casing:
- adjusting the lower adjustable expansion cone to an increased outside diameter; pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material; and

- radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:
- adjusting the lower adjustable expansion cone to a reduced outside diameter, adjusting the upper adjustable expansion cone to an increased outside diameter, pressurizing a region within the lower portion of the second wellbore casing below
- the lower adjustable expansion cone using a fluidic material; and pressurizing an annular region above the upper adjustable expansion cone using the
- wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone; and

fluidic material:

wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

- 56. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:
  - a support member defining a first fluid passage;
  - an expansion device coupled to the support member defining a second fluid passage

fluidicly coupled to the flist fluid passage;

an expandable tubular liner movably coupled to the expansion device; and an expandable shoe coupled to the expandable tubular liner;

wherein the expansion device is adjustable to a plurality of stationary positions.

- 57. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising installing a tubular liner, an adjustable expansion device, and a shoe in the borehole; radially expanding at least a portion of the shoe by a process comprising: adjusting the adjustable expansion device to a first outside diameter; and injecting a fluidic material into the shoe; and radially expanding at least a portion of the tubular liner by a process comprising: adjusting the adjustable expansion device to a second outside diameter; and injecting a fluidic material into the borehole below the adjustable expansion device.
- 58. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

diameter: and

means for installing a tubular liner, an adjustable expansion device, and a shoe in the borehole:

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the adjustable expansion device to a first outside

means for injecting a fluidic material into the shoe; and means for radially expanding at least a portion of the tubular liner comprising: means for adjusting the adjustable expansion device to a second outside diameter, and

means for injecting a fluidic material into the borehole below the adjustable expansion device.

- 59. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
  - a first wellbore casing comprising:
  - an upper portion of the first wellbore casing; and
  - a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
  - wherein the inside diameter of the upper portion of the first wellbore casing to be than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:
  - an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
  - a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;
  - wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
  - wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
    - installing the second wellbore casing and an adjustable expansion device within the barehole;
    - radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:
      - adjusting the adjustable expansion device to a first outside diameter,
    - injecting a fluidic material into the second wellbore casing; and radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:
      - adjusting the adjustable expansion device to a second outside
      - injecting a fluidic material into the borehole below the adjustable expansion device.

- 60. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:
  - a support member including a first fluid passage;
  - a first adjustable expansion device coupled to the support member including a second fluid passage fluididly coupled to the first fluid passage;
  - a second adjustable expansion device coupled to the support member including a third fluid passage fluididly coupled to the first fluid passage;
  - an expandable tubular liner movably coupled to the first and second adjustable expansion devices, and
  - an expandable shoe coupled to the expandable tubular liner.
- 61. A method of forming a wellbore casing in a subterranean formation having operation of preexisting wellbore casing positioned in a borehole, comprising:
  - installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;
  - radially expanding at least a portion of the shoe by a process comprising:

    adjusting the lower adjustable expansion device to an increased outside

    diameter; and

Injecting a fluidic material into the shoe; and

- radially expanding at least a portion of the tubular liner by a process comprising:
  adjusting the lower adjustable expansion device to a reduced outside
  diameter;
  - adjusting the upper adjustable expansion device to an increased outside diameter; and
  - injecting a fluidic material into the borehole below the lower adjustable expansion device.
- 62. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:
  - means for installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;
  - means for radially expanding at least a portion of the shoe comprising:
    - means for adjusting the lower adjustable expansion device to an increased outside diameter; and

means for injecting a fluidic material into the shoe; and means for radially expanding at least a portion of the tubular liner comprising: means for adjusting the lower adjustable expansion device to a reduced outside diameter.

means for adjusting the upper adjustable expansion device to an increased outside diameter; and

means for injecting a fluidic material into the borehole below the lower adjustable expansion device.

- 63. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
  - a first wellbore casing comprising:
  - an upper portion of the first wellbore casing; and
  - a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
  - wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:
  - an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
  - a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing:
  - wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
  - wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
    - installing the second wellbore casing, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole; radially expanding at least a portion of the lower portion of the second wellbore casing shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased outside diameter, and

injecting a fluidic material into the lower portion of the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the borehole below the lower adjustable expansion device.

64. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

an expansion device coupled to the support member including a second fluid

passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion device; and an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the

expandable shoe:

an expandable portion comprising one or more inward folds; and

a remaining portion coupled to the expandable portion;

wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion;

wherein the expansion devige is adjustable to a plurality of stationary positions.

65. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion device, and a shoe in the borehole; radially expanding at least a portion of the shoe by a process comprising: lowering the adjustable expansion device into the shoe; adjusting the adjustable expansion device to a first outside diameter.

pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using the fluidic material; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the adjustable expansion device to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion device

using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using the fluidic naterial;

wherein the first outside diameter of the adjustable expansion device in greater than the second outside diameter of the adjustable expansion device.

66. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for lowering the adjustable expansion device into the shoe;

means for adjusting the adjustable expansion device to a first outside diameter;

means for pressurizing a region within the shoe below the adjustable expansion

device using a fluidir material; and

means for pressurizing an annular region above the adjustable expansion device using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the adjustable expansion device to a second outside diameter;

means for pressurizing a region within the shoe below the adjustable expansion device using a fluidid material; and

means for pressurizing an a mular region above the adjustable expansion device using the fluidic material;

wherein the first outside diameter of the adjustable expansion device is greater than the second outside demeter of the adjustable expansion device.

- 67. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
  - a first wellbore casing comprising:

process of:

- an upper portion of the first wellbore casing; and
- a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
- wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:
- an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
- a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;
- wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
- wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the
- installing the second wellbore casing and an adjustable expansion device in the borehole:
- radially expanding at least a portion of the lower portion of the second wellbore casing by a process complising:
- lowering the adjustable expansion device into the lower portion of the second wellbore casing;
- adjusting the adjustable expansion device to a first outside diameter;
- pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion device using a fluidic material; and
- pressurizing an annular region above the adjustable expansion device using the fluidic material; and
- radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:
- adjusting the adjustable expansion device to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using that

wherein the first outside diameter of the adjustable expansion device is greater than the second outside diameter of the adjustable expansion device.

- 68. An apparatus for forming a wellbore casing in a borehole located in a subtenencen formation including a presisting vellbore casing, comprising:
  - a support member including a first fluid passage;
  - a first adjustable expansion device coupled to the support member including a

second fluid passage fluidicty coupled to the first fluid passage;

a second adjustable expansion device coupled to the support member inchaing n third fluid passage fluididy coupled to the first fluid passage;

an expandable tubular liner movably coupled to the first and second adjustable expansion devices; and

an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the

expandable shoe;

an expandable portion comprising one or more inwards folds; and

a remaining portion coupled to the expandable portion;

wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.

69. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a stoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the lower adjustable expansion device into the shoe;

adjusting the lower adjustable expansion device to an increased outside diameter;

pressurizing a region within the shoe below the lower adjustable expansion device

using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion device using the fluidic material and

radially expanding at least a portion of the tubular liner by a process comprising: adjusting the lower adjustable expansion device to a reduced outside diameter, adjusting the upper adjustable expansion device to an increased outside diameter; pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion device using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion device is greater than the increased outside diameter of the upper adjustable expansion device; and

wherein the reduced outside diameter of the lower adjustable expansion device is less than or equal to the increased outside diameter of the upper adjustable expansion device.

70. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for lowering the lower adjustable expansion device into the shoe;

means for adjusting the lower adjustable expansion device to an increased outside diameter;

means for pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion device using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion device to a reduced outside

means for adjusting the upper adjustable expansion device to an increased outside diameter.

- means for pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and
- means for pressurizing an annular region above the upper adjustable expansion device using the fluidic material;
- wherein the increased outside diameter of the lower adjustable expansion daylos is greater than the increased outside diameter of the upper adjustable expansion device; and
- wherein the reduced outside diameter of the lower adjustable expansion device is less than or equal to the increased outside diameter of the upper adjustable expansion device.
- 71. A wellbore casing positioned in alborehole within a subterranean formation comprising:
  - a first wellbore casing comprising
  - an upper portion of the first wellbore casing; and
  - a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
  - wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:
  - an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
  - a lower portion of the second wellipore casing coupled to the upper portion of the second wellbore casing;
  - wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
  - wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;
  - wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
  - installing the second wellbore casing, an upper adjustable expansion device, and a lower adjustable expansion device in the borehole;
  - radially expanding at least a portion of the shoe by a process comprising:

the fluidic material:

lowering the lower adjustable expansion device into the lower portion of the second wellbore casing;

adjusting the lower adjustable expansion device to an increased outside diameter; pressurizing a region within the lower person of the second wellbore casing below

the lower adjustable expansion device using a fluidic material; and pressurizing an annular region above the upper adjustable expansion device using the fluidic material; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter; adjusting the upper adjustable expansion device to an increased outside diameter; pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion device using a fluidic material; and pressurizing an annular region above the upper adjustable expansion device using

wherein the increased outside diameter of the lower adjustable expansion device is greater than the increased outside diameter of the upper adjustable expansion device; and

wherein the reduced outside diameter of the lower adjustable expansion device is less than or equal to the increased outside diameter of the upper adjustable expansion device.

72. An apparatus for radially expanding and plastically deforming a tubular member, comprising:

means for injecting fluidic materials into the tubular member to radially expand and plastically deform the tubular member; and

means for radially expanding and plastically deforming the tubular member by displacing an expansion device within the tubular member.

73. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion device, and a shoe in the borehole; radially expanding at least a portion of the shoe by a process comprising: adjusting the adjustable expansion device to a first outside diameter, and

injecting a fluidic material into the shoe; and radially expanding at least a portion of the tubular liner by a process comprising: adjusting the adjustable expansion device to a second outside diameter; and displacing the adjustable expansion device relative to the tubular liner.

74. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion device, and a shap in the borehole:

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the adjustable expansion device to a first outside

diameter; and

means for injecting a fluidle material into the shoe; and
means for radially expanding at least a portion of the tubular liner comprising:
means for adjusting the adjustable expansion device to a second outside
diameter; and

means for displacing the adjustable expansion device relative to the tubular liner.

- 75. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
  - a first wellbore casing comprising:
  - an upper portion of the first wellbore casing; and
  - a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
  - wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising:
  - an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
  - a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing; wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing and an adjustable expansion device within the boreholes

radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a first outside diameter;

Injecting a fluidic material into the second wellbore casing; and radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a second outside diameter, and

displacing the adjustable expansion device relative to the tubular liner.

76. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased outside

diameter; and

injecting a fluidic material into the shoe; and radially expanding at least a portion of the tubular liner by a process comprising: adjusting the lower adjustable expansion device to a reduced outside diameter:

adjusting the upper adjustable expansion device to an increased outside diameter; and

displacing the upper adjustable expansion device relative to the tubular liner.

77. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the lower adjustable expansion device to an increased outside diameter; and

means for injecting a fluidig material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion device to a reduced outside diameter;

means for adjusting the upper adjustable expansion device to an increased outside diameter; and

means for displacing the upper adjustable expansion device relative to the tubular liner.

78. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbone casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and a second wellbore casing comprising;

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the inpper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing, wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole; radially expanding at least a portion of the lower portion of the second wellbore casing shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased

outside diameter, and

injecting a fluidic material into the lower portion of the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diarneter, and

displacing the upper adjustable expansion device relative to the tubular liner.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/00609

A. CLASSIFICATION OF SUBJECT MATTER						
IPC(7) : E21B 43/10						
US CL	: 166/380, 207					
	International Patent Classification (IPC) or to both n	ational classification and IPC				
B. FIELDS SEARCHED						
Minimum do	cumentation searched (classification system followed	by classification symbols)	763			
	66/380, 207, 212, 216, 217	by classification symbols)	ŀ			
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C. DOC	UMENTS CONSIDERED TO BE RELEVANT					
Category *	Citation of document, with indication, where ar	propriate, of the relevant passages	Relevant to claim No.			
A	US 2002/0033261 A1 (METCALFE) 21 March 200		1-55			
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Α	US 6,085,838 A (VERCAEMER et al.) 11 July 2000 (11.07.02), figures 5-7.		1-55			
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Further	documents are listed in the continuation of Box C.	See patent family annex.				
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Commissioner of Patents and Trademarks						
	PCT hineren D.C. 20031	David Bagnell				
Washington, D.C. 20231 Facsimile No. (703)305-3230		Telephone No. (703) 308-1113				

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